SE (EXTC) SEM III (old) NOV-DEC 2013.

D.L.D.

4/12/13

407

12 : 2nd half.13-Avi(af)

Con. 5438-13. **(OLD COURSE)** **LJ-10334**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Out of **remaining** questions, attempt any **four** questions.
(3) Assume **suitable** additional **data** if **required**.
(4) **Figures** in brackets on the **right hand side** indicate **full** marks.

1. (A) Give characteristics of logic families. (05)
(B) Compare combinational circuits with sequential circuits. (05)
(C) Implement $Y = \overline{A} + BC$ using only NAND gates. (05)
(D) Give TTL and CMOS interfacing. (05)

2. (A) Using Boolean laws prove that (10)
(i) $AB + BC + \overline{A}C = AB + \overline{A}C$
(ii) $\overline{A}BC + A\overline{B}C + AB\overline{C} + ABC = AB + BC + CA.$
(B) Write $(24)_{10}$ into its Binary, BCD code, Hexadecimal, and Ex-3 code. (10)

3. (A) Implement the following Boolean equation using single 8:1 MUX and few logic gates: (10)
$F(A,B,C,D) = \sum m(0, 1, 3, 4, 8, 9, 15).$
(B) Using Quine McClusky method, minimize the following: (10)
$F(A,B,C,D) = \sum m(0, 1, 3, 7, 8, 9, 11, 15, 22, 24, 27) + d(6, 16).$
E

4. (A) What is shift register? Explain any one type of shift register. Give its application. (10)
(B) Design Excess-3 to BCD code converter. (10)

5. (A) Draw a neat circuit of BCD adder using IC 7483 and explain. (10)
(B) Explain any one application of Johnson counter. (10)

6. (A) Design a synchronous counter using D type flip flops for getting the following sequence: 1 – 3 – 5 – 7 – 1. Take care of lockout condition. (10)
(B) It is desired to develop the circuit for controlling a lamp on a staircase between 1st and 2nd floor of a building. Each floor is having only one switch. If a lamp is made 'ON' using switch of 1st floor, one should be able to switch it 'OFF' using a switch of 2nd floor and vice-versa. Design the circuit for the same. Implement the same using only NOR gates. (10)

7. Explain the following:
(A) Conversion of D type flip flop into T type flip flop. (07)
(B) FPGA. (07)
(C) Comparison of TTL with CMOS logic families. (06)

S E Sem III (old) Electrical Networks
20/12/2013 (EXTC)

102 : 2nd – half 13 (a) – JP

Con. 5444–13. **(OLD COURSE)** **LJ–10433**

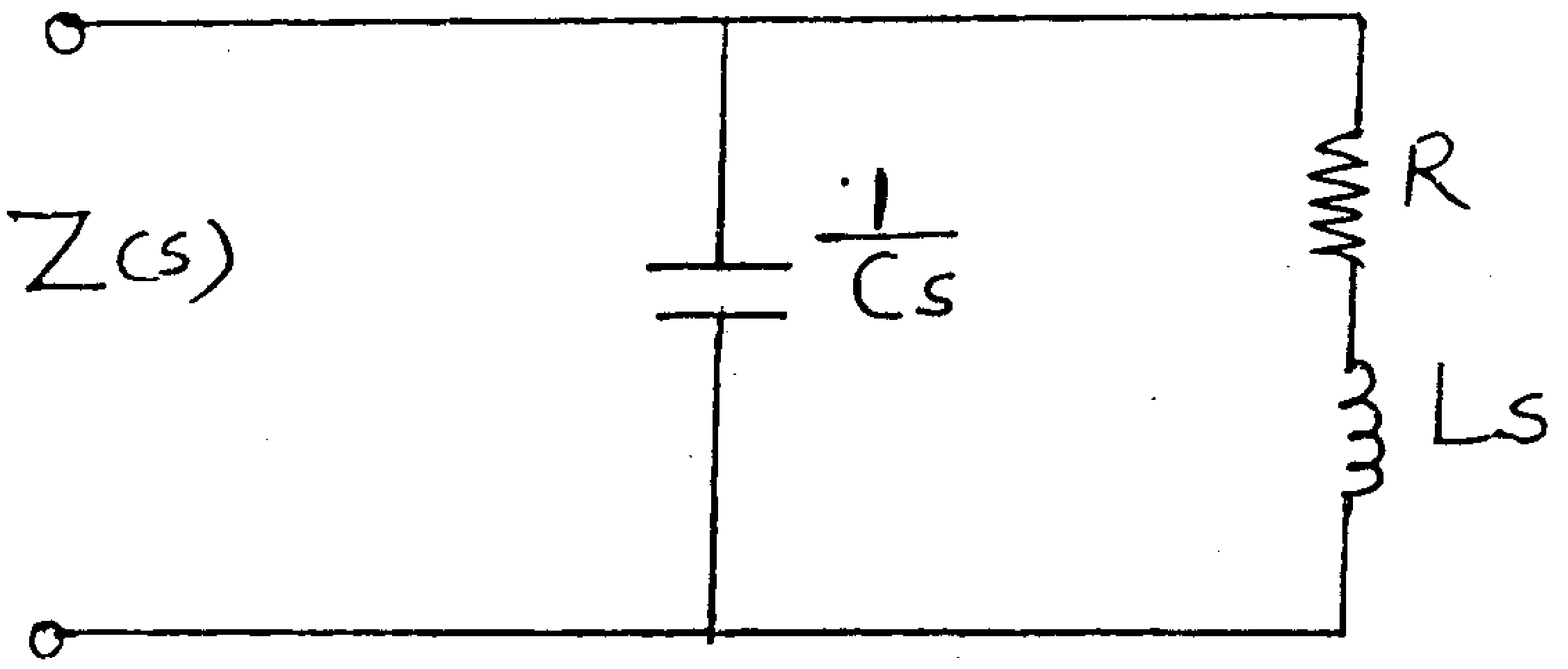
(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Answer any **four** questions from remaining **six** questions.
(3) Assume **suitable** data if **necessary** and state them **clearly**.

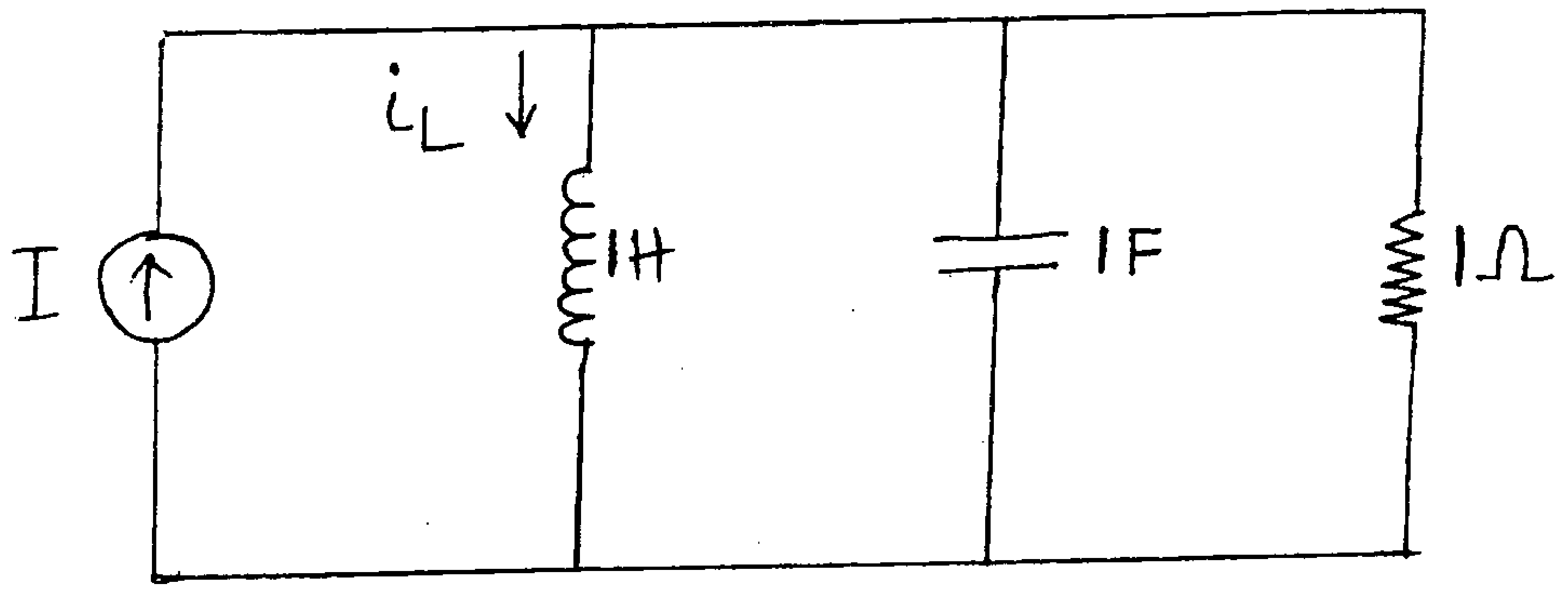
1. (a) For the network shown below, the poles and zeros of the driving point function Z(s) are at the following locations : **5**

Poles at $-\frac{1}{2} \pm j\frac{\sqrt{3}}{2}$, zero at –1.

If Z (jo) = 1, determine the values of R, L and C.



(b) For the given network, $i_L = e^{-t}$, L = 1H, C = 1F and R = 1Ω. Determine I. **5**



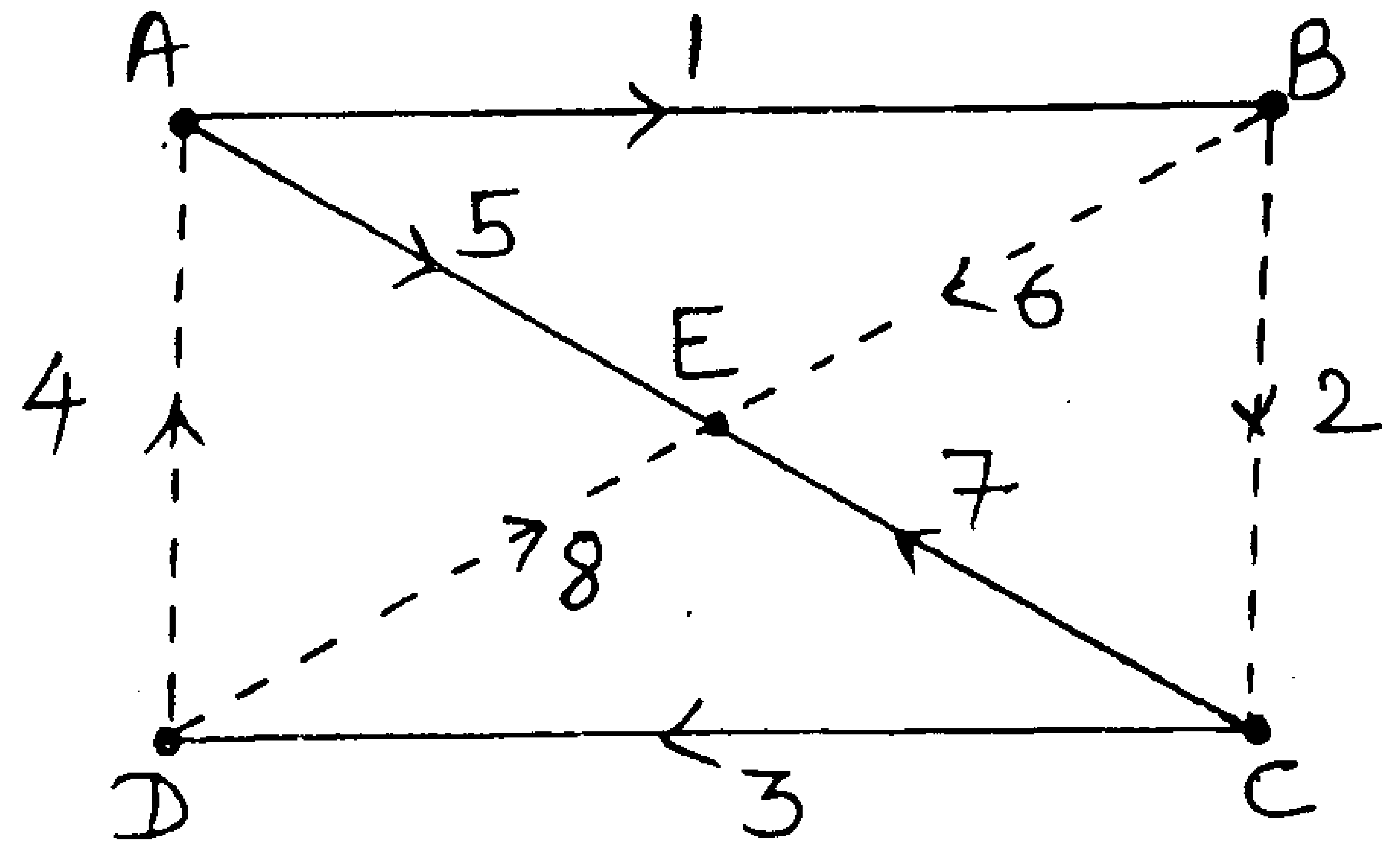
(c) For the given incidence matrix, obtain the linear graph **5**

$$A = \begin{bmatrix} -1 & 1 & 0 & 0 & 0 \\ 0 & -1 & 1 & 0 & -1 \\ 0 & 0 & -1 & 1 & 1 \end{bmatrix}$$

(d) Check for Hurwitz, $s^3 + 2s^2 + 3s + 6$ **5**

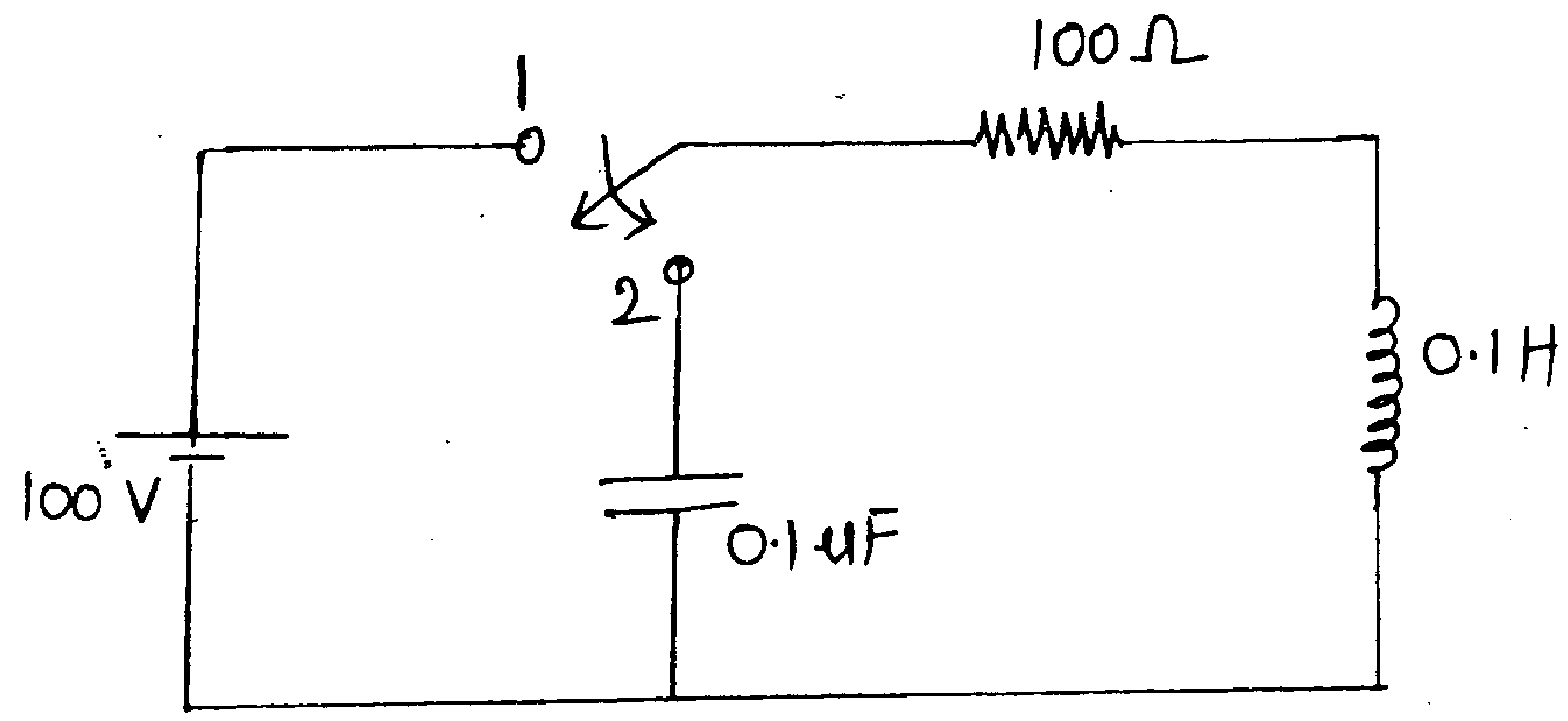
[TURN OVER

2. (a) For the given tree (shown with firm lines) obtain : **10**
   (i) Incidence matrix
   (ii) Fundamental cutset matrix
   (iii) Fundamental Tieset matrix.

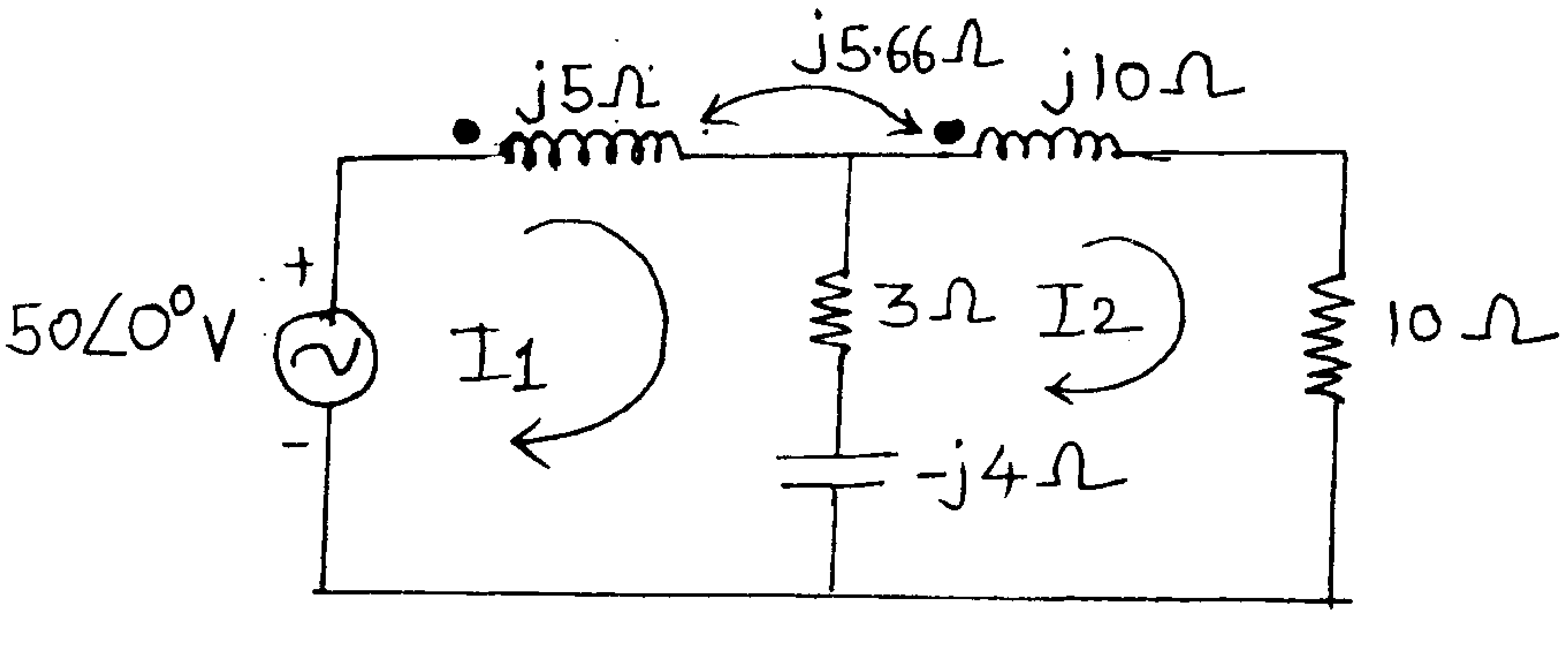


(b) For the given network, the switch is changed from position 1 to 2 at time t = 0. **10**

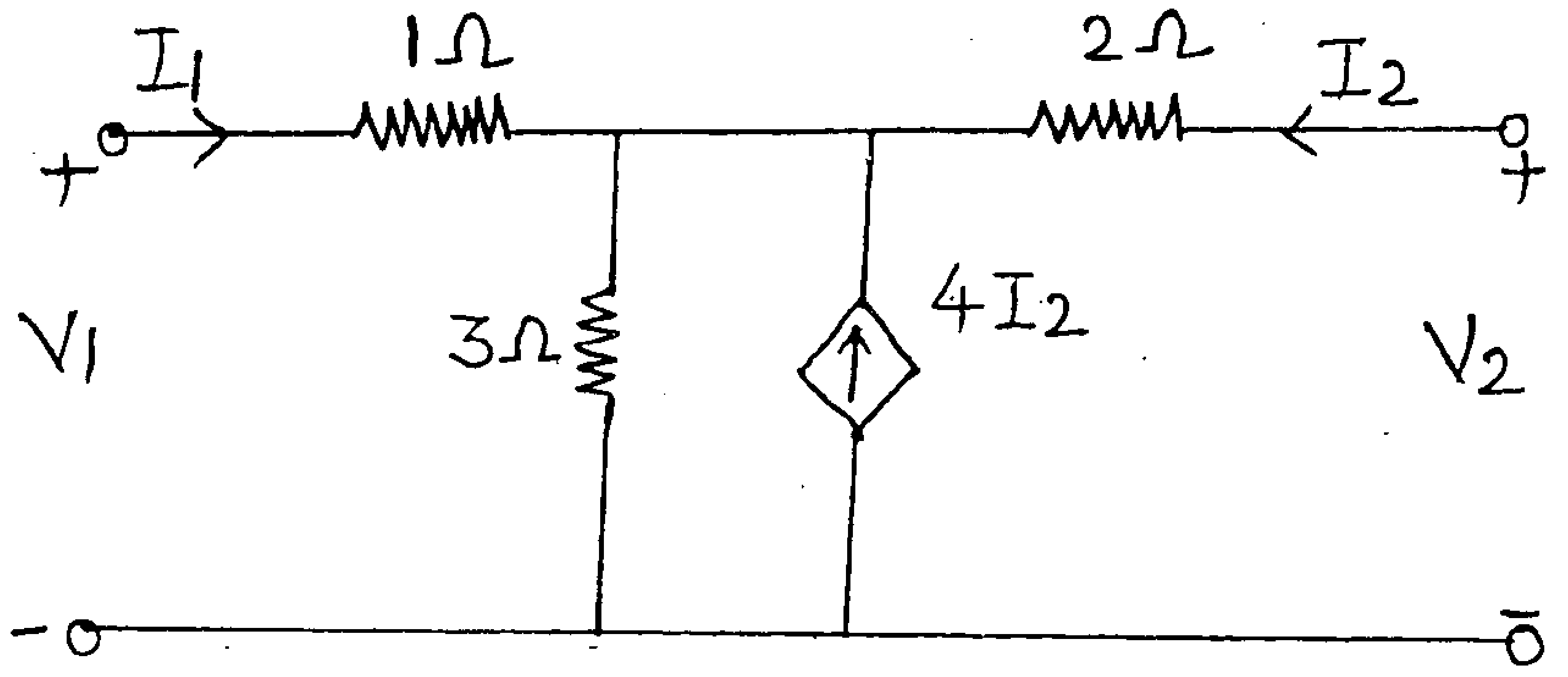
Find i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. Assume that steady state is reached at switch position 1.



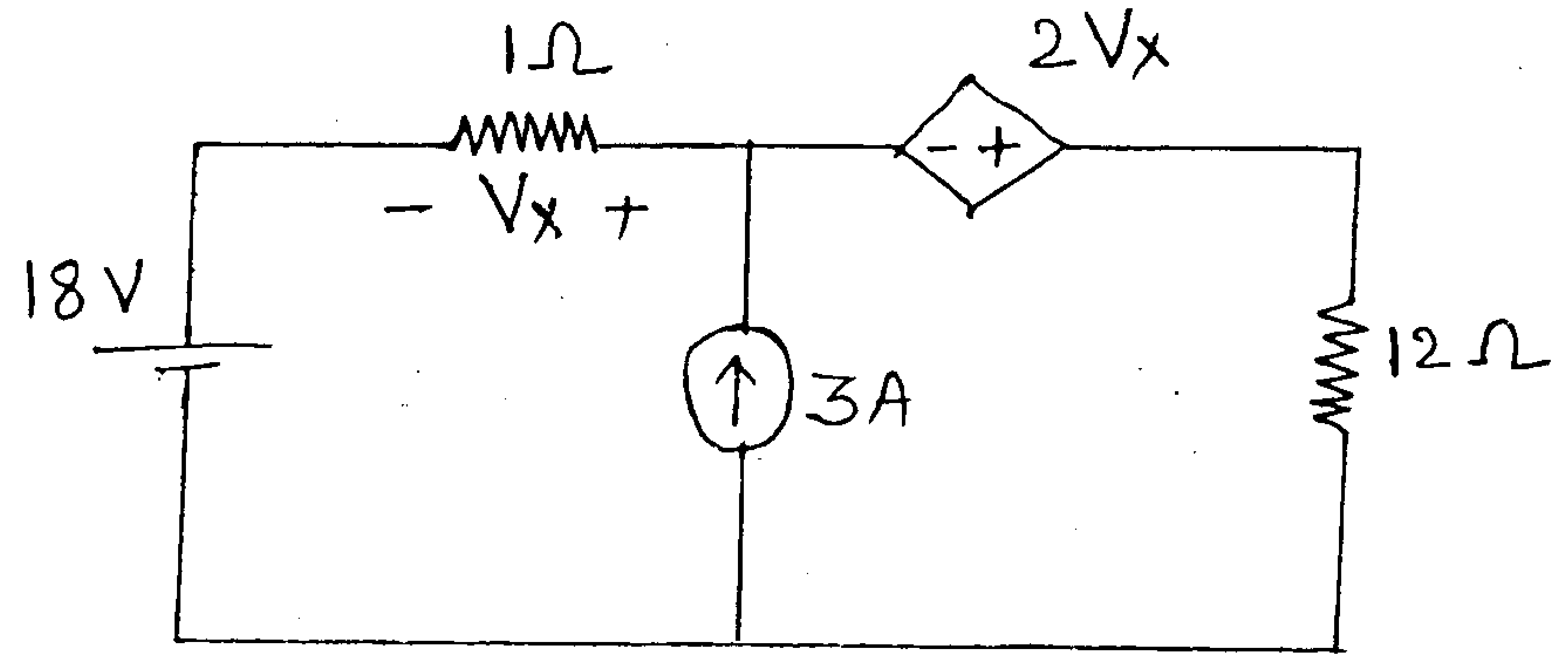
3. (a) Find the voltage across 10Ω resistor using mesh analysis. **10**



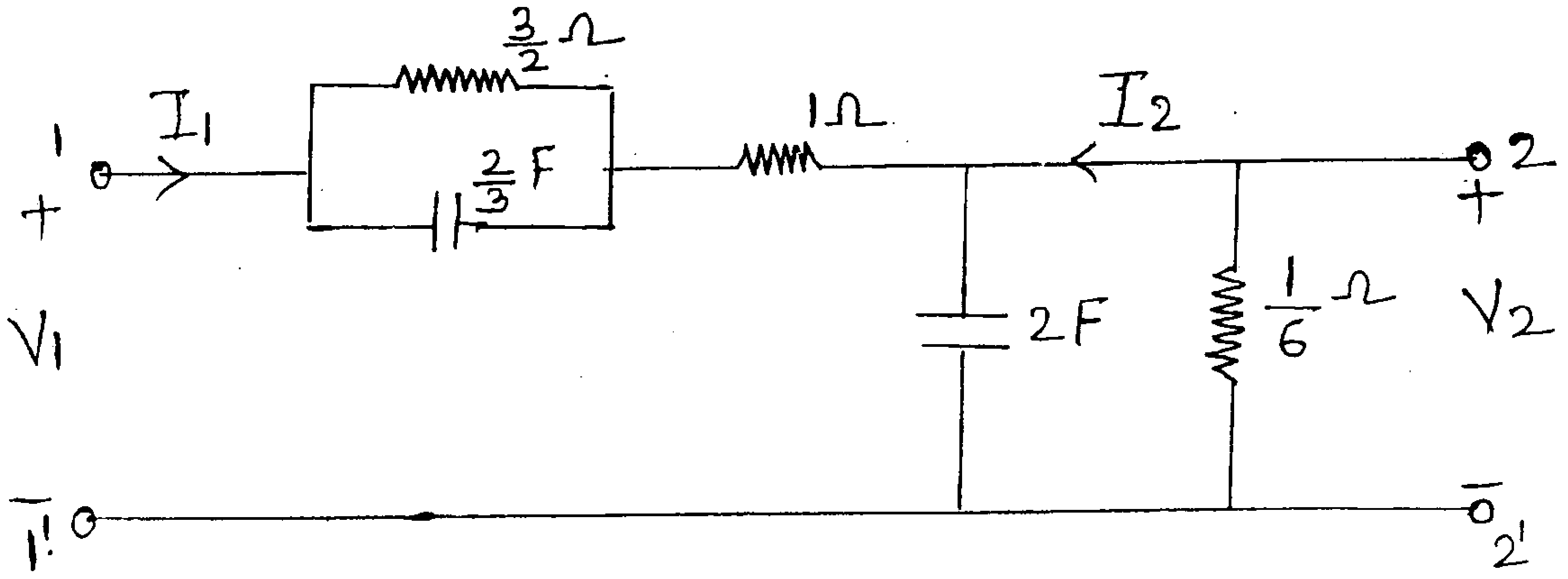
(b) For the network shown below, find the Z-parameters. **10**



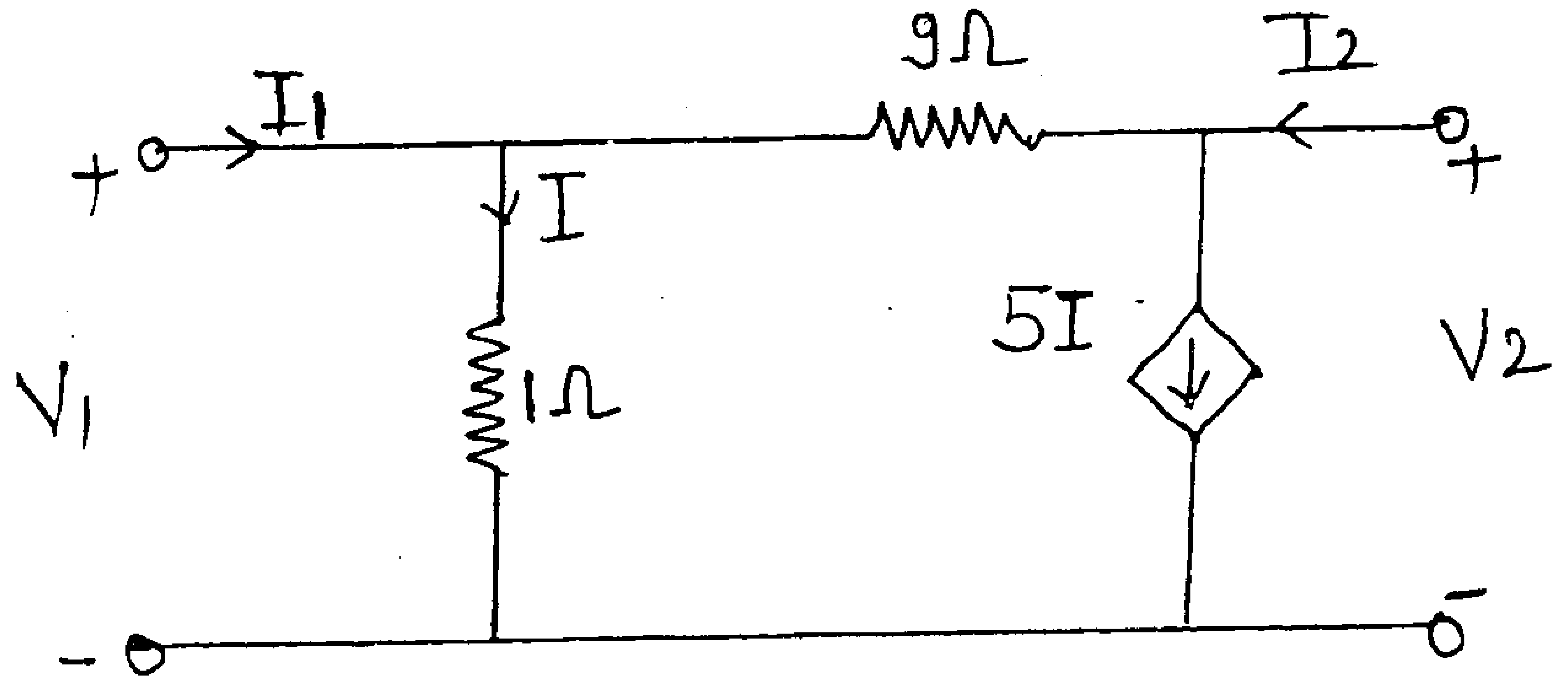
4. (a) Find the current in 12Ω resistor using Thevenin's Theorem. **10**



(b) For the given network, find out $\frac{V_2}{V_1}$ and $\frac{I_2}{I_1}$. **10**



5. (a) For the network shown, below find the h-parameters. **10**

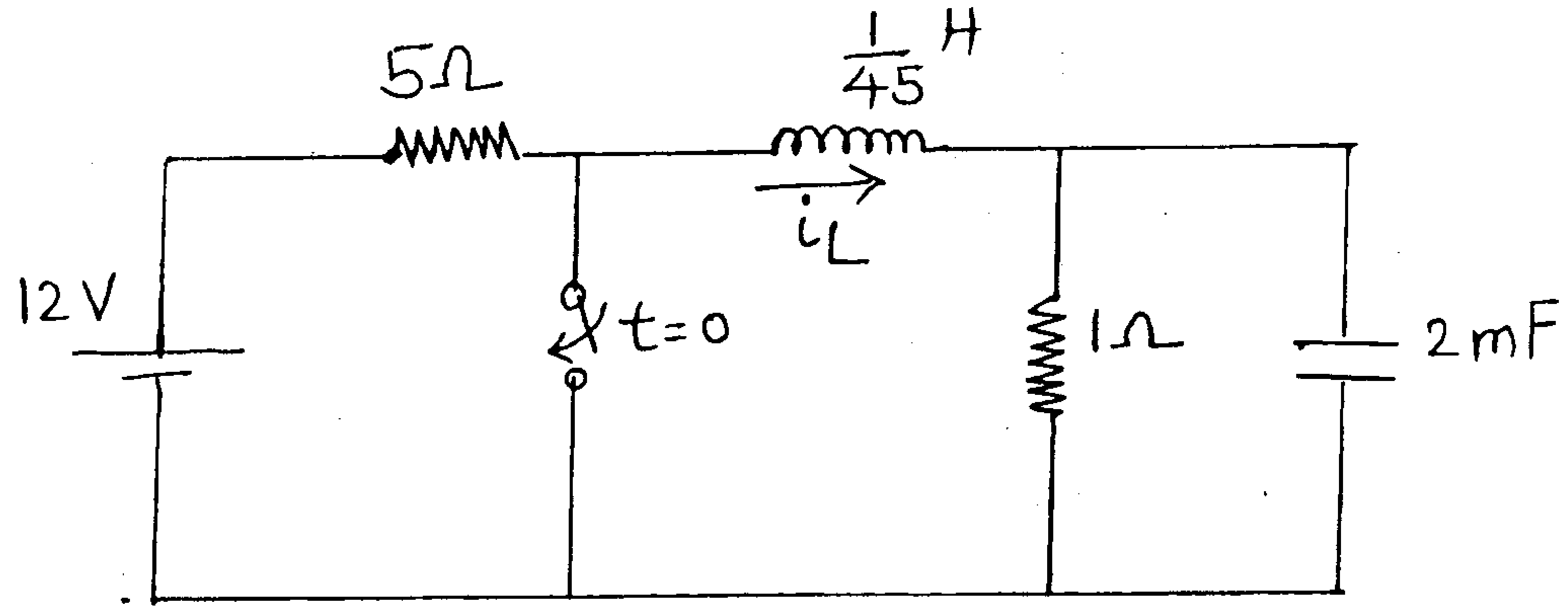


(b) Check the positive realness of the following functions : **10**

(i) $\frac{s^2 + 2s + 6}{s\,(s+3)}$

(ii) $\frac{s^2 + 4}{\left(s^3 + 3s^2 + 3s+1\right)}$.

6. (a) Find i_L (t) for t > 0. At t = 0, the switch is closed. For t < 0, the circuit is in steady state. **10**

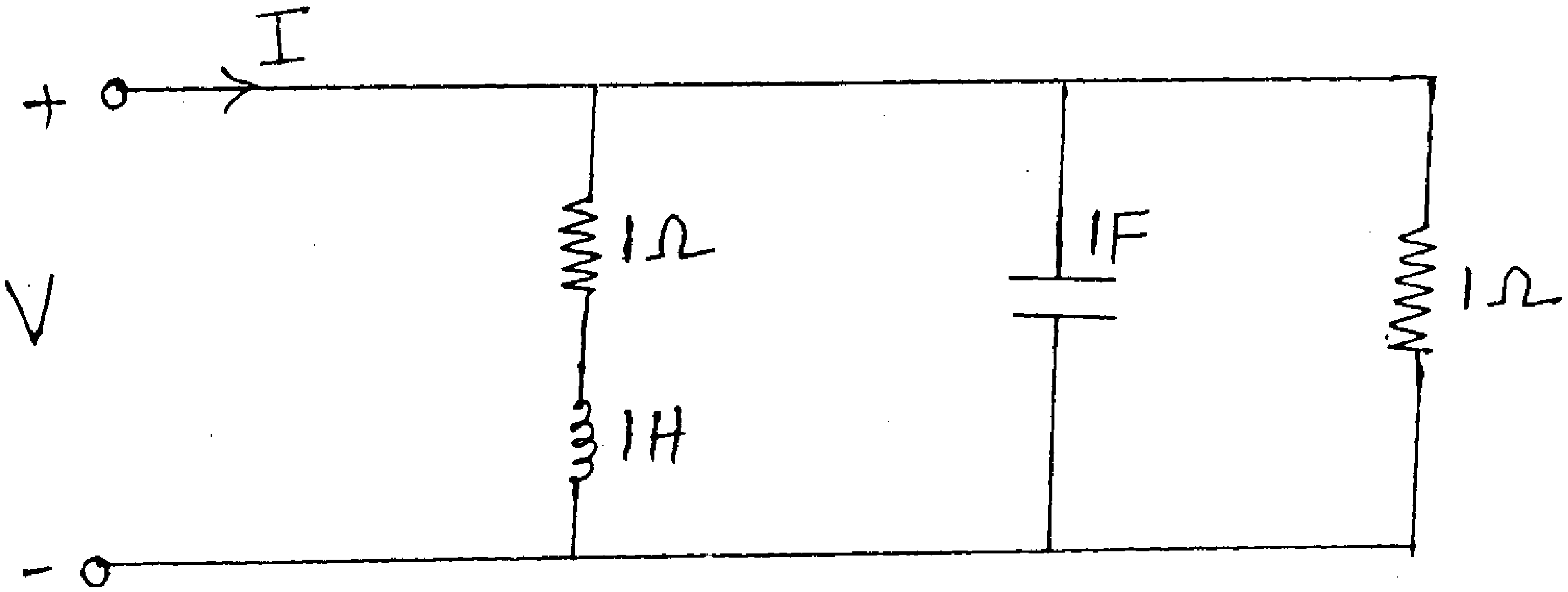


(b) Determine Cauer forms of realization of the driving point impedance function **10**

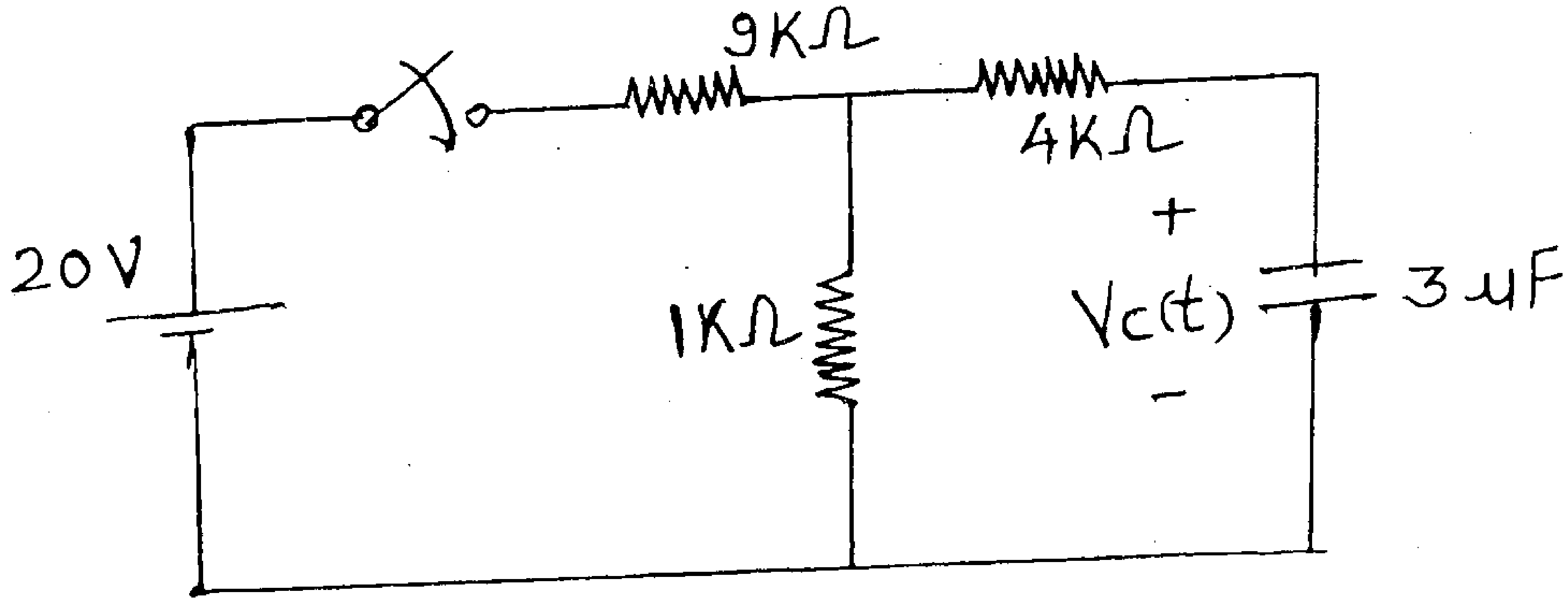
$$Z(s) = \frac{4\left(s^2+1\right)\left(s^2+9\right)}{s\left(s^2+4\right)}.$$

[TURN OVER

7. (a) Find the driving point admittance Y(s) for the network shown below and plot the pole-zero diagram. **10**



(b) For the circuit shown below, the switch closes at time t = 0. The capacitor is initially uncharged. Find V_c (t) for t > 0. **10**



EXTC ~~EXTC~~

S.E. ~~IV~~ ~~sem~~ sem III old Nov-13

Sub:- AM -III

25/11/13

301

mk.32-2nd hlf 13-(g)

Con. 8929-13. **LJ-10258**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. 1 is **compulsory**.

(2) Solve any ~~three~~ four questions from the **remaining** questions.

1. (a) Show that — **5**

$$L\left[\text{Cosh}\, t \int_0^t e^u \text{Cosh}\, u du\right] = \frac{1}{2}\left[\frac{s-2}{(s-1)^2(s-3)} + \frac{s}{(s+1)^2(s-1)}\right].$$

(b) Show that — **5**

$$Z\left[C^k \text{Cosh}\, h\alpha k\right] = \frac{Z(Z - C\,\text{Cosh}\,\alpha)}{Z^2 - 2CZ\,\text{Cosh}\,\alpha + CZ}\,(k > 0).$$

(c) Show that Fourier Sine transform of $\frac{1}{\sqrt{t}}$ is $= \frac{1}{\sqrt{s}}$. **5**

(d) Show that vectors (1, 2, 3) (3, –2, 1) and (1, –6, –5) are linearly dependent and find the relation amongst them. **5**

2. (a) Find $L^{-1}\left[\frac{(s+1)e^{-5s} + 5}{s^2 + 6s + 5}\right]$. **6**

(b) Express into product of two submatrices B and C of order 2 × 2. Find A^{-1}, B^{-1} and $(AB)^{-1}$. **6**

$A = \begin{bmatrix} 1+ab, & a \\ b, & 1 \end{bmatrix}$

(c) Find Half range Cosine series of — **8**

$$f(x) = \begin{cases} k_x & 0 \le x \le \ell/2 \\ k(\ell - x) & \ell/2 \le x \le \ell \end{cases}$$

and hence deduce that —

(i) $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$

(ii) $\frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \ldots = \frac{\pi^4}{96}$.

3. (a) Find $L\left[\frac{\text{Cosh}3t\,\text{Sin}^2 2t}{t}\right]$. **6**

(b) Show that the matrix $A = \frac{1}{2}\begin{bmatrix} \sqrt{2} & -i\sqrt{2} & 0 \\ i\sqrt{2} & -\sqrt{2} & 0 \\ 0 & 0 & 2 \end{bmatrix}$ is unitary and hence find A^{-1}. **6**

(c) Find the Fourier series of f(x) = x Sin x in (–π, π) and hence deduce that **8**

$$\frac{\pi - 2}{4} = \frac{1}{1\cdot 3} - \frac{1}{3\cdot 5} + \frac{1}{5\cdot 7} - \frac{1}{7\cdot 9} + \ldots./$$

[TURN OVER

4. (a) Find $L^{-1}\left[\dfrac{1}{(s-4)^4(s+3)}\right]$ using Convolution theorem. 6

   (b) Find half range Cosine series of $f(x) = (x-1)^2$ in $0 < x < 1$ and hence find 6

   $$\sum\frac{1}{n^2} \text{ and } \sum\frac{(-1)^{n+1}}{n^2}.$$

   (c) Solve completely — 8

   $7x + y + z = a^2$
   $4x + 5y + 7z = -a$
   $3x - 4y - 6z = 2.$

5. (a) Evaluate $\int_0^\infty e^{-3t}\, t^2 \operatorname{erf} 2\sqrt{t}\, dt$ using Laplace transform. 6

   $$\left(\text{Given that } L\left[\operatorname{erf}\sqrt{t}\,\right] = \frac{1}{s\sqrt{s+1}}\right).$$

   (b) Solve using Laplace transform — 6

   $$\frac{dy}{dt} + 2y + \int_0^t y\, dt = \operatorname{Sin} t,\ y(0) = 1.$$

   (c) Find the ranks by reducing the matrix A to Normal form.
   (i) $A = [\,a_{ij}\,]_{3\times3}$ where $a_{ij} = i + j$. 4
   (ii) $A = [\,a_{ij}\,]_{3\times3}$ where $a_{ij} = {}^{i}/_{j}$. 4

6. (a) Find the complex form of Fourier series for $f(x) = 2x$ in $(0, 2\pi)$. 6

   (b) Solve by Gauss-Jordan Method :— 6

   $2x - 6y + 8z = 24,$
   $5x + 4y - 3z = 2,$
   $3x + y + 2z = 16.$

   (c) Find :—

   (i) $L^{-1}\left[\log\left(s^4+4\right)\right]$ 4

   (ii) $L^{-1}\left[\frac{1}{5}\log\left(\frac{s+3}{s+4}\right)\right]$. 4

7. (a) Find — 6

   $Z\left[3^k \operatorname{Cos} h\alpha\, k\right],\ k \geq 0.$

   $f_2(x) = 1$ ↑

   (b) Show that $f_4(x) = 5x^3 - 3x$ is orthogonal to $\{f_1, f_2, f_3\}$ where $f_1(x) = x$, $f_3(x) = x^2$ in $(-\ell, \ell)$. 6

   (c) Solve by Gauss-Seidal Method performing four iterations, 8

   $23x + 4y - z = 32$
   $2x + 17y + 4z = 35$
   $x + 2y + 10z = 24$

S.E. (EXTC) III old, 29/11/13

Electronics Devices & Circuits I

RT–Exam.–Oct.–13–4–61

Con. 5414–13. **(OLD COURSE)** **LJ–10295**

(3 Hours) **[Total Mars : 100**

N.B. : (1) Questions No. **1** and **2** are **compulsory**.
(2) Out of remaining questions attempt any **three** questions.
(3) In all **five** questions to be attempted.
(4) **Figures** to the **right** indicate **full** marks.

1. Design single stage R-C coupled CE audio frequency amplifier employing BC147B BJT to satisfy the following requirements. **[20]**
$|Av| \geq 90$, $S_{ICO} \leq 10$, **Load resistor** $R_L = 10K\Omega$ **and Output voltage** Vo=2volts.

2. Design single stage R-C coupled CS audio frequency amplifier employing JFET BFW-11 to satisfy the following requirements. **[20]**
$| Av | \geq 10$, $I_{DQ} = 2.5$ mA RL = 100 KΩ, $V_{DD} = 20$ volts and Output peak voltage Vo = 3.5volts.

3. a With the help of neat circuit diagram explain the operation of BJT shunt voltage regulator and derive for its line regulation and load regulation. **[10]**

3. b Sketch the input output characteristic curves for a transistor in CB connection and show how to obtain graphically the four parameters hib, hfb, hrb, and hob? **[10]**

4. a **Multiple Choice Question:** **[5x2]**

i. A voltage of **200cos100t** is applied to a half-wave rectifier with a load resistor of **5kΩ**. The rectifier is represnted by an ideal diode in series with a resistor of **1kΩ**. The maximum value of current, d.c. component of current and r.m.s. value of current will be respectively,
a) 33.33 mA 10.61mA,& 16.67mA b) 22.22 mA 8.61mA,& 13.38mA
c) 28.33 mA 14.61mA,& 13.33mA d) 40 mA 20mA, & 25mA

ii. The series type regulator is suitable for
(a) low current high voltage (b) low current low voltage
(c) high current low voltage (d) high current high voltage

iii. Voltage gain of a common gate amplifier with $\mu = 15$, rd = 20 K, RL = 2 K, internal resistance of the voltage source = 2 K is
(a) 0.64 (b) 6.4 (c) 0.89 (d) 0.9

iv. The h-parameters of a BJT are
(a) dependent on RL (b) dependent on ICQ (c) independent of ICQ
(d) constant

v. The relationship between input and output voltage of a common emitter amplifier is
(a) always unity (b) always positive (c) always negative (d) less than unity

[TURN OVER

4.b What is the principle of providing thermal stabilization by means of different methods of transistor biasing? Explain the bias compensation techniques using a diode and thermistor or sensitor **[10]**

5. a **[5x2]**

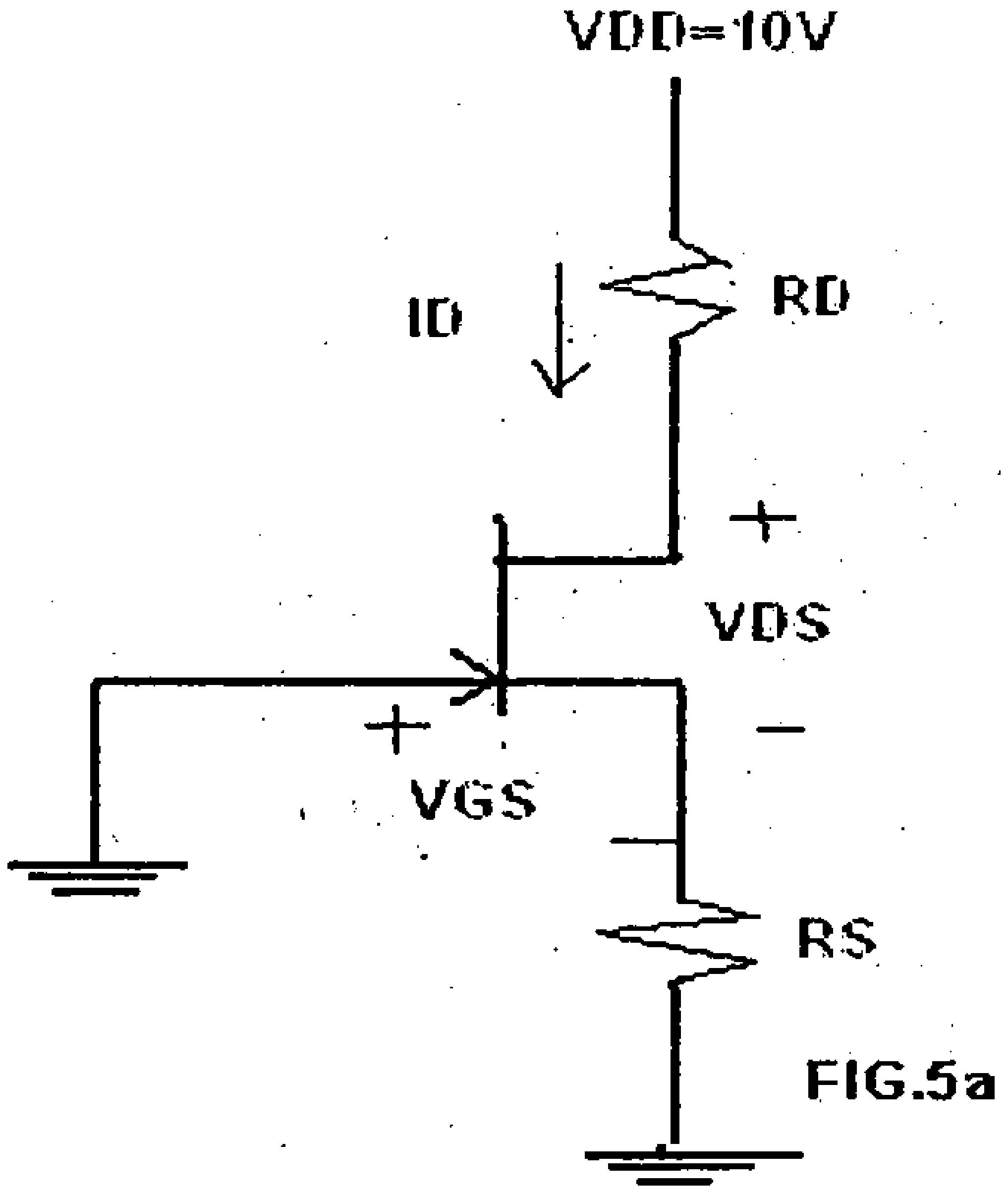


FIG.5a

For the circuit in Figure 5a the JFET parameters are $\mathbf{I_{DSS} = 5\ mA}$, $\mathbf{Vp = -4V}$. Determine the following with $\mathbf{I_D = 2\ mA}$ **and** $\mathbf{V_{DS} = 6V}$

- i) R_D ii) R_S iii) V_D (voltage between drain terminal and ground)
- iv) VS (voltage between source terminal and ground)
- ii) V_{RD} (voltage across R_D)

5. b The silicon transistor in the amplifier stage shown in Fig. 5.b has collector resistance of $r_c = 1.5\ M\Omega$. Determine the following **[3+3+4]**

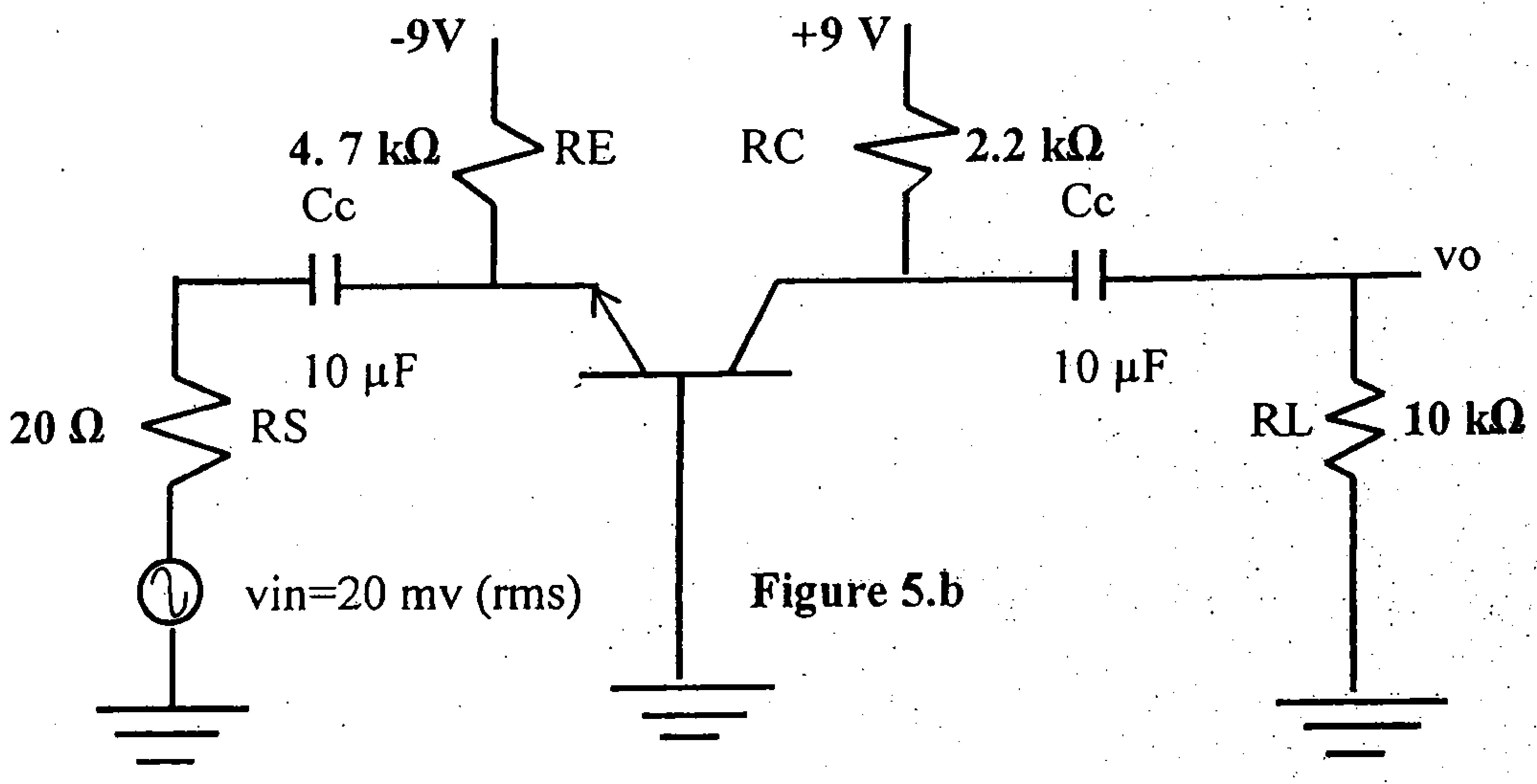


Figure 5.b

1. Input impedance of the amplifier
2. Output impedance of the amplifier
3. The rms load voltage of the amplifier

6. a Design a full wave rectifier dc supply using center tapped transformer with two diodes to give dc output voltage at 150 volts to a variable resistive load. The load current expected is 50 ± 10 mA with ripple factor not to exceed 0.07. **Use LC filter** **[10]**

6. b **[10]**

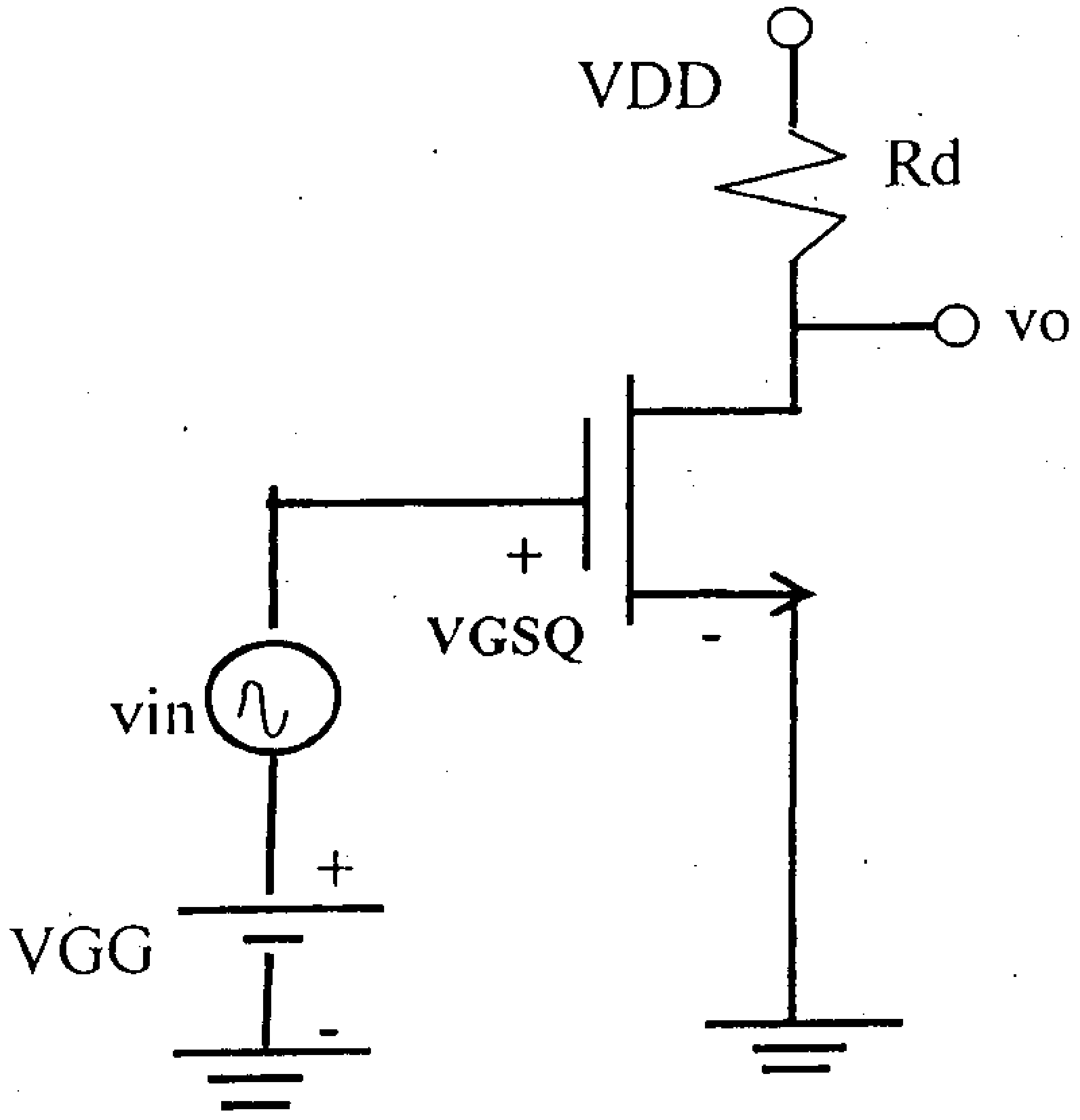


Fig.6b

Determine the small signal voltage gain of a MOSFET circuit with VGSQ = 2.12 V, VDD = 5 V, Rd = 2.5 kΩ, VTN = 1 V, Kn = 0.8 mA/V2 and λ = 0.02 V^{-1} (body effect coefficient). Assume transistor (Fig.6b) is biased in the saturation region

7. Explain in brief **[4x5]**

i. Line & Load regulation of BJT shunt regulator
ii. Transfer characteristic of JFET
iii. How triggering of an SCR can be controlled by the gate signal applied
iv. How do we bias JFET against device variation

DBEC DATA SHEET

Transistor type	Pdmax @ 25°C Watts	Icmax @ 25°C Amps	$V_{CE}^{(sat)}$ volts d.c.	V_{CBO} volts d.c.	V_{CEO} (Sus) volts d.c.	V_{CER} (Sus) volts d.c.	V_{CEX} volts d.c.	V_{BEO} volts d.c.	T_j max °C	D.C. current gain min	D.C. current gain typ.	D.C. current gain max.	Small Signal h_{fe} min.	Small Signal h_{fe} typ.	Small Signal h_{fe} max.	V_{BE} max.	0_{fe} °C/W	Derate above 25°C W/°C
2N 3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8	1·5	0·7
ECN 055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5	3·5	0·4
ECN 149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2	4·0	0·3
ECN 100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	0·05
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2N 525(PNP)	0·225	0·5	0·25	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—
BC147B	0·25	0·1	0·25	50	45	50	—	6	125	200	290	450	240	330	500	0·9	—	—

Transistor type	hie	hoe	hre	θja
BC 147A	2·7 K Ω	18µ ℧	1.5×10^{-4}	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25µ ℧	3.2×10^{-4}	—
BC 147B	4·5 K Ω	30µ ℧	2×10^{-4}	0·4°C/mw
ECN 100	500 Ω	—	——	——
ECN 149	250 Ω	—	——	——
ECN 055	100 Ω	—	——	——
2N 3055	25 Ω	—	——	——

BFW 11—JFET MUTUAL CHARACTERISTICS

$-V_{GS}$ volts	0·0	0·2	0·4	0·6	0·8	1·0	1·2	1·6	2·0	2·4	2·5	3·0	3·5	4·0
I_{DS} max. mA	10	9·0	8·3	7·6	6·8	6·1	5·4	4·2	3·1	2·2	2·0	1·1	0·5	0·0
I_{DS} typ. mA	7·0	6·0	5·4	4·6	4·0	3·3	2·7	1·7	0·8	0·2	0·0	0·0	0·0	0·0
I_{DS} min. mA	4·0	3·0	2·2	1·6	1·0	0·5	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0

N-Channel JFET

Type	V_{DS} max. Volts	V_{DG} max. Volts	V_{GS} max. Volts	P_d max. @25°C	T_j max.	I_{DSS}	g_{mo} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{ja}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 µ℧	6	50 KΩ	2 mW/°C	0·59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 µ℧	2·5	50 KΩ	——	0·59° C/mW

UJT type	P_d max. @25°C	I_E max. @25°C	I_P peak pulse current max.	V_{B2E} Volts max.	V_{B2B1} Volts	T_j max	η min.	η max.	R_{BB}KΩ min.	R_{BB}KΩ typ.	Max.	I_P max. µA	I_V min. mA	I_{EO} µA
2N2646	300mW	50mA	2Amp.	30	35	125°C	0·56	0·75	4·7	7·0	9·1	5·0	4·0	−2·0

S.E (Sem III) Old oTR ExTC 16/12/13

Numerical Technique

2nd Half-2013-mina-(d)-86

Con. 6500-13. **LJ - 10385**

(3 Hours) **[Total Marks : 100**

N. B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** out of remaining **six** questions.
(3) Make **suitable** assumptions if **required** and **justify** the **same**.

1. (a) Volume of a certain solid V is calculated using formula $V = 64\frac{xy^4}{z^2}$ where $x, y \,\&\, z$ denote three dimensions. If maximum possible errors in the $x, y \,\&\, z$ is limited to plus minus 0.001. Estimate the maximum probable error in the calculation of volume if the normal dimension $x, y \,\&\, z$ are equal to unity. 5

(b) Define the operators $\Delta, \nabla, \delta, \mu \,\&\, E$. Prove that 5

i) $2\mu\delta = \Delta + \nabla$ ii) $E = 1 + \Delta$

(c) Using Picard's method solve 5

$\frac{dy}{dx} = 1 + xy$ such that $y = 0$ when $x = 0$.

(d) Derive the equation for Regula – falsi method using geometrical interpretation. 5

2. (a) List the bracketing methods and open methods and find the real root of the equation $x\sin x + \cos x = 0$ using Newton Raphson method correct to three decimal places. 10

(b) Solve the following equations by Gauss - Seidel method.
$27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$. 10

3. (a) From the following table find the number of students who obtained marks less than 45. 10

Marks	30-40	40-50	50-60	60-70
No. of students	31	42	51	35

(b) Using Newton's divided difference formula, find the value of f(9) from the following table. 10

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

4. (a) Write a program for Lagrange's interpolation method and using this formula, find the value of y when $x = 10$ from the following table. 10

x	5	6	9	11
y	12	13	14	16

(b) Fit a second degree parabola to the following data: 10

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

[TURN OVER

5. (a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Trapezoidal, Simpson's $\frac{1}{3}^{rd}$ and Simpson's $\frac{3}{8}^{th}$ rule. 10

(b) Solve $\frac{dy}{dx} = x + y$ with $x_0 = 0$, $y_0 = 1$ by Euler's modified formula find the value of y when $x = 0.5$ taking $h = 0.25$. 10

6. (a) Solve $\frac{dy}{dx} = x^2 + y$ with initial conditions $y(1) = 2$ and find y at $x = 1.2$, $x = 1.4$ by Runge - Kutta Method of Fourth Order taking $h = 0.2$. 10

(b) Solve the following set of equations using Gauss Elimination method. 10

$$2x + y + z = 10, \quad 3x + 2y + 3z = 18, \quad x + 4y + 9z = 16.$$

7. (a) Explain the propagation of errors. 5

(b) Using Adams – Bashforth method, obtain the solution of $\frac{dy}{dx} = x - y^2$ at $y(0.8)$, given values 10

x	0	0.2	0.4	0.6
y	0	0.0200	0.0795	0.1762

(c) Write a short note on Golden section search. 5